Advanced Organic Waste Gasifier, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

The Advanced Organic Waste Gasifier (AOWG) is a novel technology to convert organic wastes from space exploration outposts into clean water and gases suitable for venting with the overall goal of minimizing vehicle mass for Mars transit and return missions. The AOWG integrates steam reformation, and electrolysis to convert organic waste into water and a small amount of inorganic matter and oxygen products, thereby reducing transit fuel and tankage mass. The AOWG reduces risks associated with storing, handling, and disposing food waste and packaging, waste paper, wipes and towels, gloves, fecal matter, urine brine, and maximum absorbency garments in microgravity environments. The gasifier provides nearly complete conversion of feeds to valuable water and jettisoned gas with minimal losses and consumables requirements. The AOWG incorporates significant novel enhancements to previous state-of-the-art Trash to Gas (TtG) steam reforming technology including a feed preparation system, continuous feeder, and tar destruction reactor to produce clean water. The AOWG crew operation requirements consist of packaging wastes in a manner similar to the 'football' preparation methods currently used in state-of-the art TtG systems but are not limited to this preparation method. The actual operation of the AOWG is largely automated and requires minimal crew intervention. The proposed Phase I AOWG will be developed with a focus on achieving the maximum waste mass reduction simultaneous with water production using feeding, materials handling, and ancillary systems geared to microgravity operations. These concepts will be integrated into a flight ready Phase II design, which will simulate a microgravity environment necessary to operate the AOWG through startup, steady operation, and shutdown. This progression of development will lead to implementation in advanced human space missions.

Anticipated Benefits

AOWG system is key for human space exploration, converting organic crew wastes into clean water, a small mass of sterile inorganic residue, and clean gases suitable for venting from the spacecraft. The AOWG is targeted toward minimizing overall transit vehicle mass, which minimizes mass requirement for propellants and tankage. Waste mass reduction with water recovery is critical for life support and to reduce overall flight costs.

AOWG has applicability for terrestrial energy recovery, fuel synthesis, and chemicals synthesis from renewable resources, agricultural wastes, municipal wastes, and other organic-containing wastes including paper and plastics. These organic-containing resources can be processed by AOWG methods to produce syngas, which can be further converted into methanol or other fuels and chemicals using Fischer-Tropsch or other catalytic synthesis processes.

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Pioneer Astronautics

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Continued on following page.

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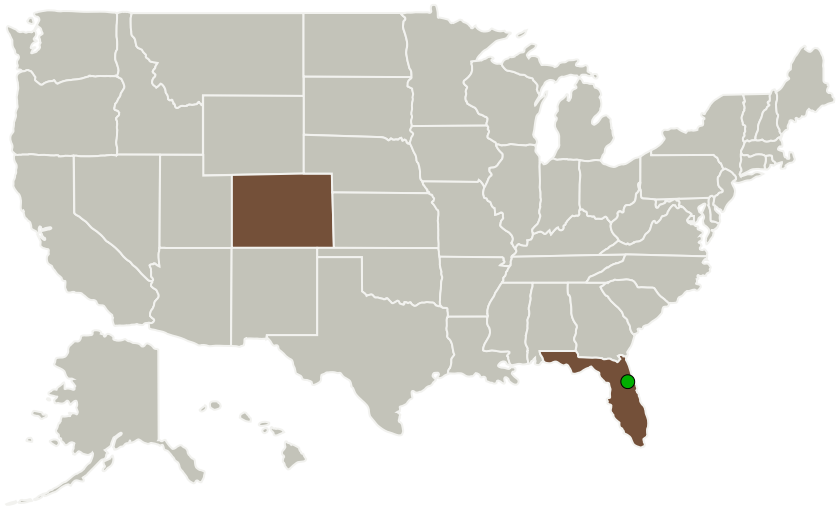
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Pioneer Astronautics	Lead Organization	Industry Historically Underutilized Business Zones (HUBZones)	Lakewood, Colorado
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
Colorado	Florida

Project Transitions

July 2018: Project Start

Project Management *(cont.)*

Program Manager:

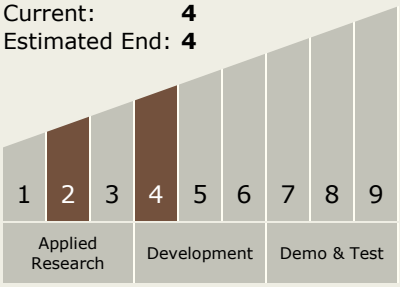
Carlos Torrez

Principal Investigator:

Stacy Carrera

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.3 Waste Management

Target Destinations

Earth, The Moon, Mars

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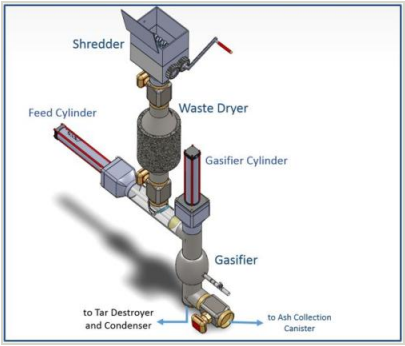
February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140913)*

Images

Briefing Chart Image
Advanced Organic Waste Gasifier, Phase I
(https://techport.nasa.gov/image/129211)



Final Summary Chart Image
Advanced Organic Waste Gasifier, Phase I
(https://techport.nasa.gov/image/130173)